

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
22 January 2004 (22.01.2004)

PCT

(10) International Publication Number  
WO 2004/008033 A1

(51) International Patent Classification<sup>7</sup>: F24F 1/02

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(21) International Application Number:  
PCT/EP2003/007394

(22) International Filing Date: 9 July 2003 (09.07.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
VI2002A000154 10 July 2002 (10.07.2002) IT

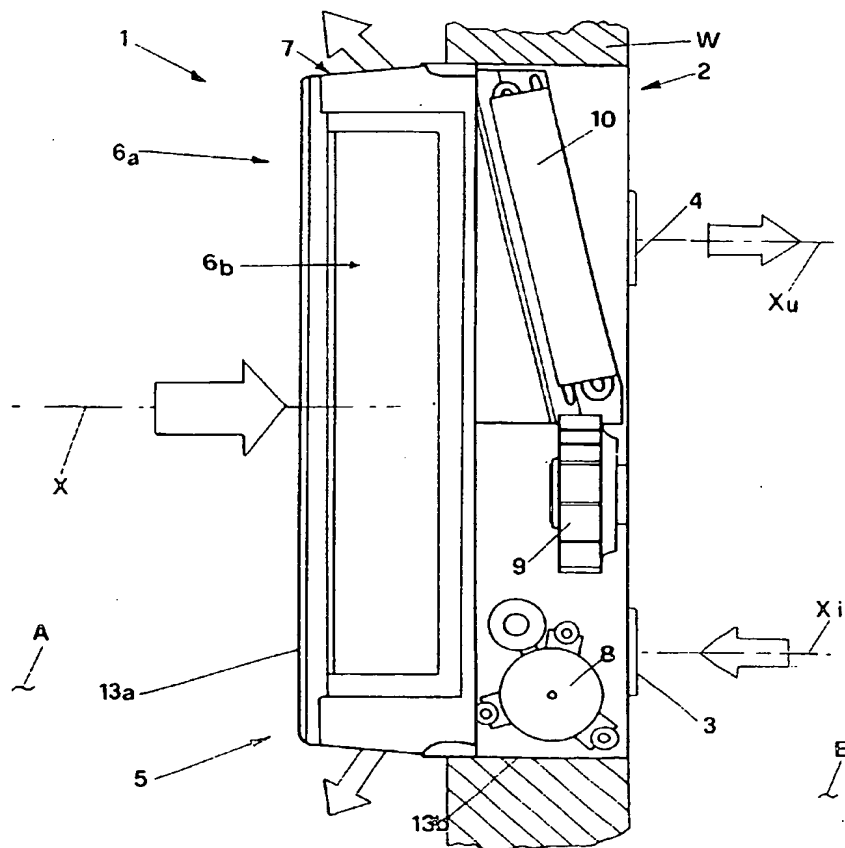
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(81) Designated States (national): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,  
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,  
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE,  
SG, SK, SI, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ,  
VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW).  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM).  
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,  
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,  
SE, SI, SK, TR). OAPI patent (BF, BJ, CF, CG, CI, CM,  
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: ENBLOC AIR CONDITIONER



(57) Abstract: An enbloc air conditioner (1) comprising: a condenser unit (2) crossed by a flow of air external to the room to be conditioned (A) between an inlet (3) and an outlet (4); an evaporator unit (5) crossed by a flow of air internal to the room to be conditioned (A) between an intake (6a, 6b) and a delivery way (7). Both the units (2, 5) are arranged in a single container (13) in which they are aligned one behind the other according to an axis (X) parallel to the directions of inlet (Xi) and outlet (Xu) of the external air flow through the intake (3) and the outlet (4) of the condenser unit (2).

WO 2004/008033 A1

Best Available Copy

WO 2004/008033 A1



**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

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## ENBLOC AIR CONDITIONER.

The present invention relates to an enbloc air conditioner.

It is well known that air conditioners are used to obtain optimal comfort conditions in working or dwelling rooms by controlling temperature and/or humidity.

According to a first design, conditioners are provided with two separated units, more particularly a condenser unit arranged outside and connected by refrigerant conveying tubes to an evaporator unit arranged in the room to be conditioned.

A drawback of the above mentioned installations is the need of providing ducts for the refrigerant conveying tubes and cables for the electric power.

Another drawback is that the outside arrangement of the condenser unit generally involves aesthetic problems, especially in buildings of the old town centers.

In order to remove such drawbacks enbloc conditioners are now available combining the condenser unit and the evaporator unit in a single structure which is generally installed in the wall inside the room to be conditioned.

More particularly the condenser unit is in communication with outside through inlet and outlet for outside air made in the building walls or in the window panes, while the evaporator unit is provided with intake and delivery ways for the air to be treated which is withdrawn from the room and then introduced again in the same room after the treatment.

To this purpose several designs are available, one of which for instance having the condenser unit and the evaporator unit arranged in the same container juxtaposed one aside the other.

According to other designs the condenser unit and the evaporator unit are still arranged in a single container but juxtaposed one above the other.

These enbloc conditioners in both above mentioned designs do not have any environmental impact to the outside excepting the air inlet and outlet of the condenser unit.

Said conditioners however occupy more space in the room where they are installed, just because both condenser and evaporator units are arranged inside, and such overall dimensions may not be acceptable in some situations, for example in small volume rooms such as little flats or studios.

Another problem of the enbloc conditioners is the arrangement in the room to

be conditioned of both condenser and evaporator units with corresponding fans involving an increase of noise. In some cases such a noise may not be acceptable especially when the conditioner is to be installed for instance in bedrooms.

5 The present invention aims at overcoming said limitations and drawbacks.

More particularly an object of the invention is to provide an enbloc air conditioner having smaller size relative to equivalent enbloc conditioners of the prior art with the same output.

Another object of the invention is to provide a conditioner emitting lower noise  
10 relative to equivalent enbloc conditioners of the prior art.

The foregoing objects are attained by an enbloc air conditioner that according to the main claim comprises:

- a condenser unit crossed by an outside air flow to the room to be conditioned between at least an inlet and at least an outlet;

- 15 - an evaporator unit crossed by a flow of air internal to the room to be conditioned between at least an intake and at least a delivery way,

and is characterized in that both said units are arranged in a single container in which they are aligned one behind the other according to an axis parallel to the inlet and outlet directions of said external air flow through said at least one inlet

20 and one outlet of said condenser unit.

According to the invention the container defines a first part where the evaporator unit is arranged and a second part where the condenser unit is arranged, wherein only the first part of the container where the evaporator unit is arranged is projecting inside the room while the second part where the  
25 condenser unit is arranged is built in into the wall.

According to an executive variation the container is arranged on the windowsill so that the second part where the condenser unit is arranged projects outside the room to be conditioned relative to the vertical closure plane defined by the window rolling shutter.

30 Advantageously the enbloc conditioner of the invention when compared with equivalent conditioners of the prior art with equal output is less bulky and has a better aesthetic look for the room where it is installed relative to equivalent conditioners of the prior art.

Still advantageously the reduction of dimensions enhances installation of  
35 enbloc conditioners even in rooms of small size.

In a further advantageous way the possibility to arrange the condenser unit in the wall thickness, allows to obtain a deadening effect reducing noise in the room to be conditioned.

The foregoing objects and advantages will be better understood by the description of a preferred embodiment of the invention with reference to the accompanying sheets of drawings in which:

- Fig. 1 is an isometric front view of the conditioner of the invention;
- Fig. 2 is an isometric rear view of the conditioner of the invention;
- Fig. 3 is an inner view of the conditioner of fig. 1;
- Fig. 4 is an inner view of the conditioner of fig. 2;
- Fig. 5 is a longitudinal section of the conditioner of the invention in the installed condition;
- Fig. 5a is a cross sectional view of the conditioner of the invention in the installed condition;
- Fig. 6 shows an installation form of the conditioner of the invention; and
- Figs. 7 and 8 show another installation form of the conditioner of the invention.

The air conditioner of the invention is shown in the isometric views of figs. 1 to 5 where it is generally indicated with 1.

One can see that the conditioner comprises a condenser unit generally indicated with 2, crossed by a flow of outside air between an inlet 3 and an outlet 4 and an evaporator unit generally indicated with numeral 5, crossed by a flow of air internal to the room to be conditioned between intakes 6a, 6b and a delivery way 7.

More particularly the inlet 3 and outlet 4 consist of holes of big diameter, preferably not lower than 160 mm.

Both the condenser unit 2 and the evaporator unit 5 are of a kind known per se wherein:

- the condenser unit 2 comprises: a compressor 8 for the refrigerant, a fan 9 withdrawing external air through the inlet 3 and a condenser bank 10 crossed by the air conveyed by the fan 9 before passing through the outlet 4;
- the evaporator unit 5 comprises: a fan 11 withdrawing internal air through the front intake 6a and top intake 6b and an evaporator bank 12 arranged upstream on the suction side of fan 11, cooling air before it goes out

through the delivery way 7 directed downwards.

The compressor 8, the condenser bank 10 and the evaporator bank 12 are hydraulically connected to each other to refrigerant exchange tubes and additional means according to the prior art and moreover the compressor 8 and the fans 9 and 11 are electrically connected to the electricity mains.

According to the invention, both the condenser unit 2 and the evaporator unit 5 are arranged in a single container 13 in which they are aligned one behind the other according to an axis X parallel to the directions of inlet Xi and outlet Xu of the outside air flow through the condenser unit 2.

More particularly in the container 13 a first part 13a is defined in which the evaporator unit 5 is arranged and a second part 13b in which the condenser unit 2 is arranged.

On installation the second part 13b as shown in greater detail in figs. 5 and 6, is arranged in a proper opening made in the wall W of the room with the inlet 3 and outlet 4 facing the external ambient E, while the first part 13a of the same container 13 is facing the internal room A to be conditioned.

In such a way the space occupied by the conditioner inside the room A to be conditioned is limited only to the projection of the first part 13a to the advantage of space occupation and aesthetic look, particularly felt in rooms of small size such as for instance the rooms of small flats or studios.

Moreover the arrangement of the second part 13b comprising the entire condenser unit 2 in the thickness of the wall W, absorbs the noise of the fan 9 that consequently is not transmitted inside the room A.

In this way in the room A to be conditioned the same noise level is obtained, that is found when using traditional conditioners not of the enbloc type provided with a separate condenser unit arranged outside.

An installation form of the conditioner of the invention is shown in fig. 6 where one can see that the second part 13b of the container 13 is arranged within the thickness of the wall W while only the first part 13a corresponding to the evaporator unit projects inside the room A. One can see that the intakes 6a and 6b are facing the front part and the ceiling of the room respectively, and the delivery way 7 is inclined facing downwards.

It is anyway clear that such an arrangement is only an illustrative one as the user may choose other configurations more suitable for his requirements.

Another installation form of the conditioner of the invention is shown in fig. 7

which is useful as removable application especially by night when the blinds are closed.

Indeed in this installation form one can see that the conditioner generally indicated with 1, is arranged on the windowsill D of a window F where the second part 13b of the container 13 where the condenser unit 2 is arranged, is facing the outside ambient E relative to the descent plane of the rolling shutter P.

A suitable insulation 15 is arranged at the conditioner sides to fit its size to the dimensions of the window F, while a spacer S is arranged on the windowsill D to make the conditioner flush with the window frame T, the conditioner being fixed to the windowsill D, through one or more clamps M.

On the basis of the foregoing description one can see that the conditioner of the invention attains all the intended objects.

More particularly the object is attained to provide an enbloc conditioner requiring less space inside the room where it is installed in comparison with equivalent enbloc conditioners of the prior art.

The further object is also attained to provide a conditioner having a lower environmental impact to the outside relative to the conditioners of the split system because the condenser unit is fully arranged inside the wall in which the conditioner is installed.

It is clear that the conditioner of the invention may be made of any shape and with different output power according to the requirements.

Possible constructional variations that should be made even neither described nor shown in the figures, when falling within the scope of the appended claims, should be considered all protected by the present invention.

## CLAIMS

1) An enbloc air conditioner (1) comprising:

- a condenser unit (2) crossed by a flow of air external to the room to be conditioned A between at least an inlet (3) and at least an outlet (4);
- 5 - an evaporator unit (5) crossed by a flow of air internal to the room to be conditioned A between at least an intake (6a, 6b) and at least a delivery way (7),

**characterized in that** both said units (2, 5) are arranged in a single container (13) in which they are aligned one behind the other according to an axis (X) parallel to the directions of inlet (Xi) and outlet (Xu) of said external air flow through said at least one intake (3) and one outlet (4) of said condenser unit (2).

2) The enbloc air conditioner (1) according to claim 1)  
**characterized in that** in said container (13) a first part (13a) is defined wherein said evaporator unit (2) is arranged and a second part (13b) in which said condenser unit (5) is arranged, only said first part (13a) of said container (13) in which said evaporator unit (5) is arranged, projecting inside said room (A) to be conditioned.

3) The enbloc air conditioner (1) according to claim 2)  
**characterized in that** said second part (13b) of said container (13) in which said condenser unit (2) is arranged, is built-in in a wall (W) of said room (A) to be conditioned.

4) The enbloc air conditioner (1) according to claim 2)  
**characterized in that** said container (13) is arranged on the windowsill (D) of a window (F) and has said second part (13b) projecting outside relative to the descent plane of the rolling shutter (P) closing said window (F).

5) The enbloc air conditioner (1) according to claim 1)  
**characterized in that** said at least one intake of said evaporator unit (5) comprise a first vertical intake (6a) and a second inclined intake (6b) pointing upwards.

6) The enbloc air conditioner (1) according to claim 1)  
**characterized in that** said evaporator unit (5) is provided with an inclined air delivery opening (7) pointing downwards.

7) The enbloc air conditioner (1) according to claim 1)  
**characterized in that** said condenser unit (2) comprises at least a refrigerant



compressor (8), at least a condenser bank (10) and at least a fan (9) arranged upstream said condenser bank (10).

8) The enbloc air conditioner (1) according to claim 1) **characterized in that** said evaporator unit (5) comprises at least an evaporator bank (12) and at least a fan (11) arranged upstream said evaporator bank.

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10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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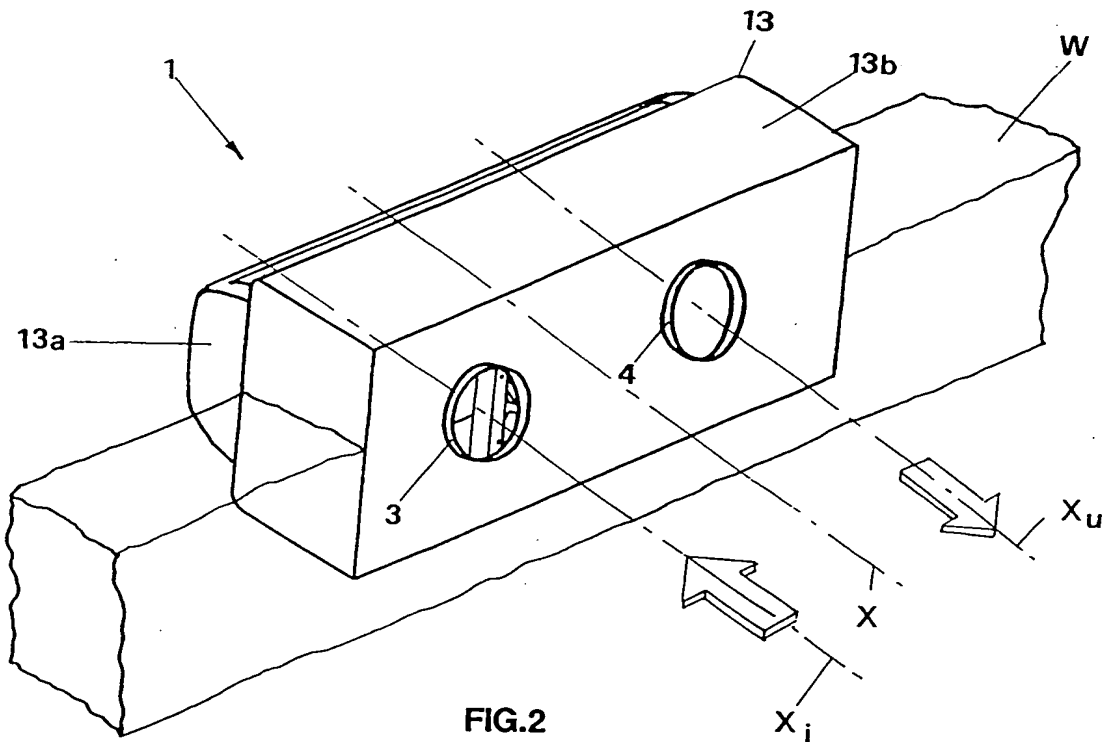
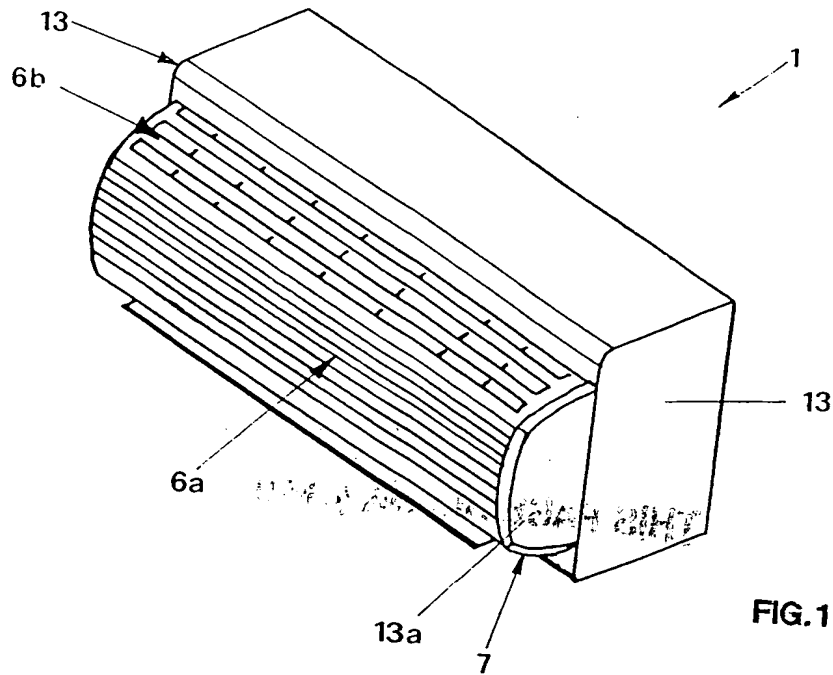
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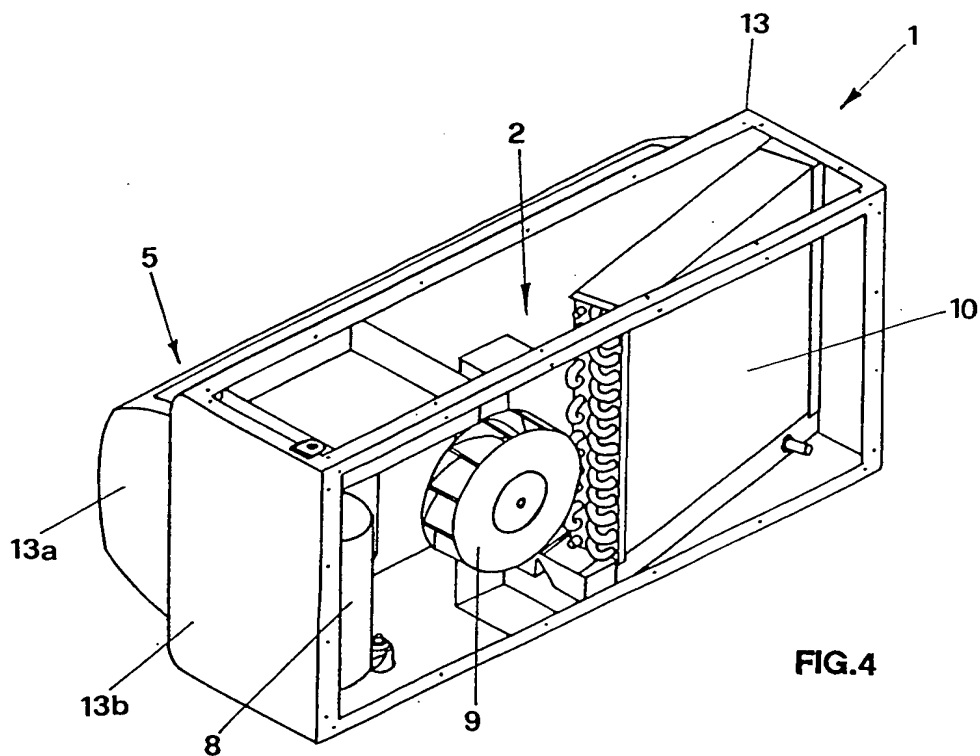
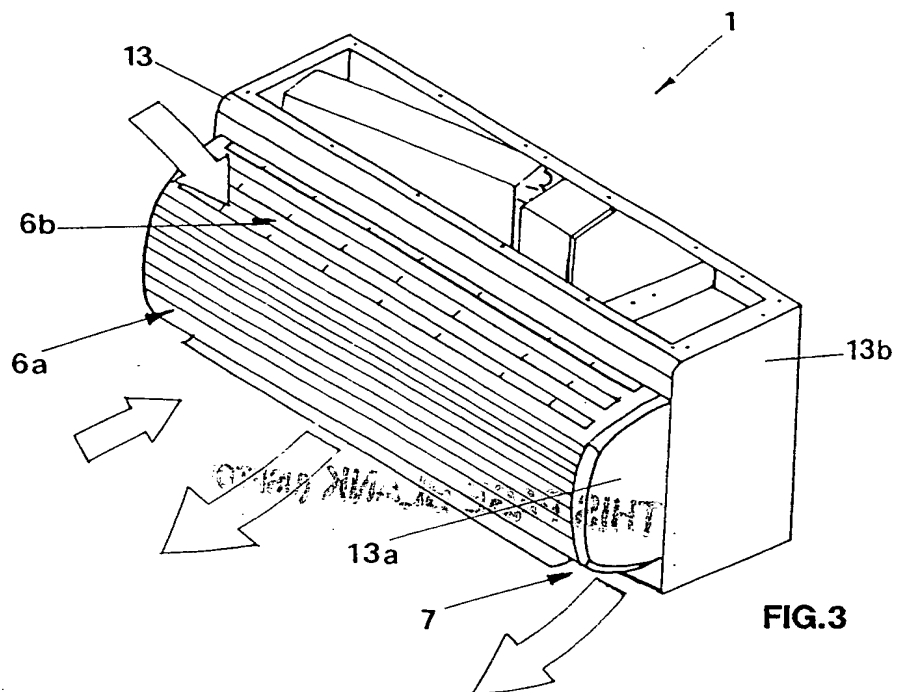
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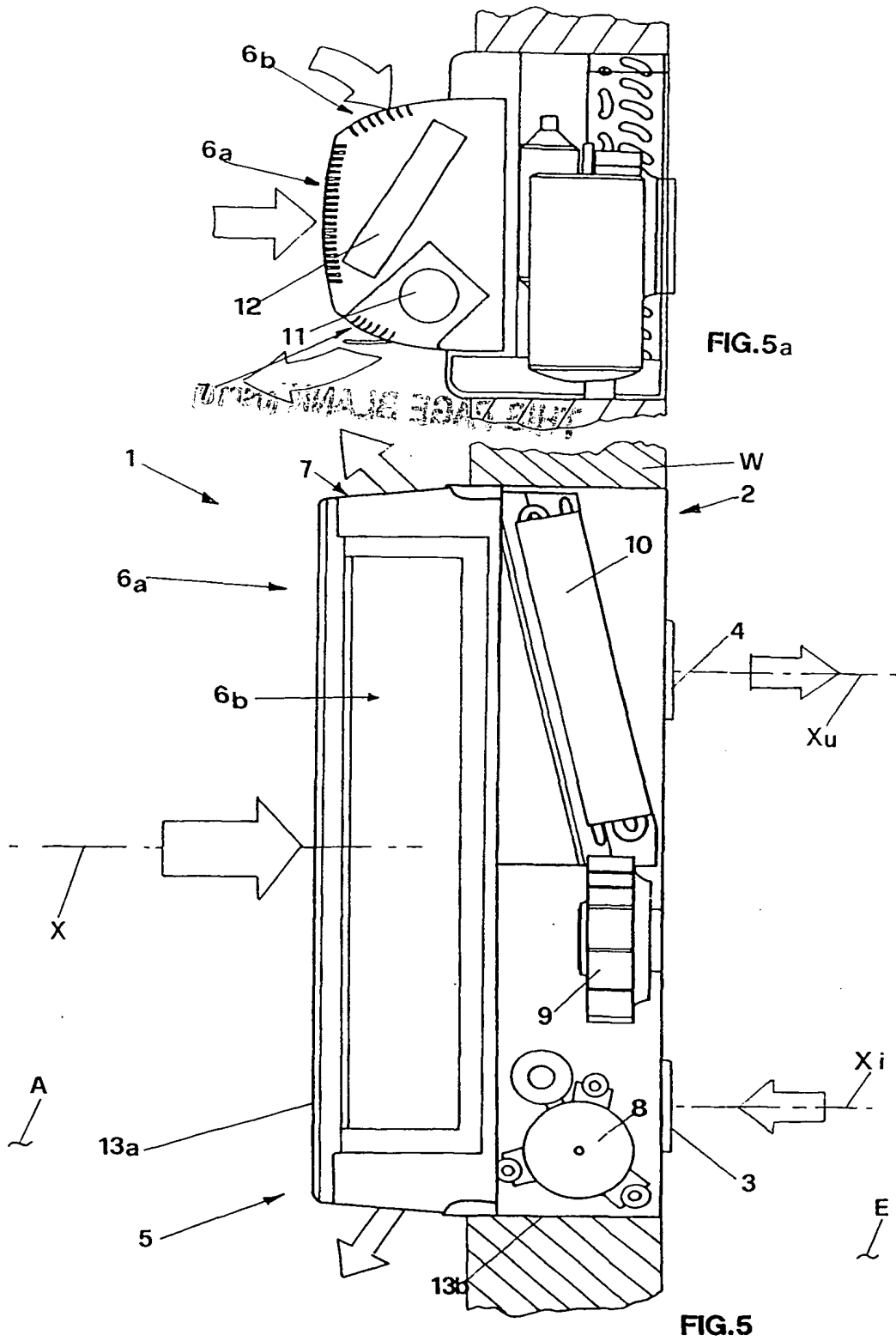
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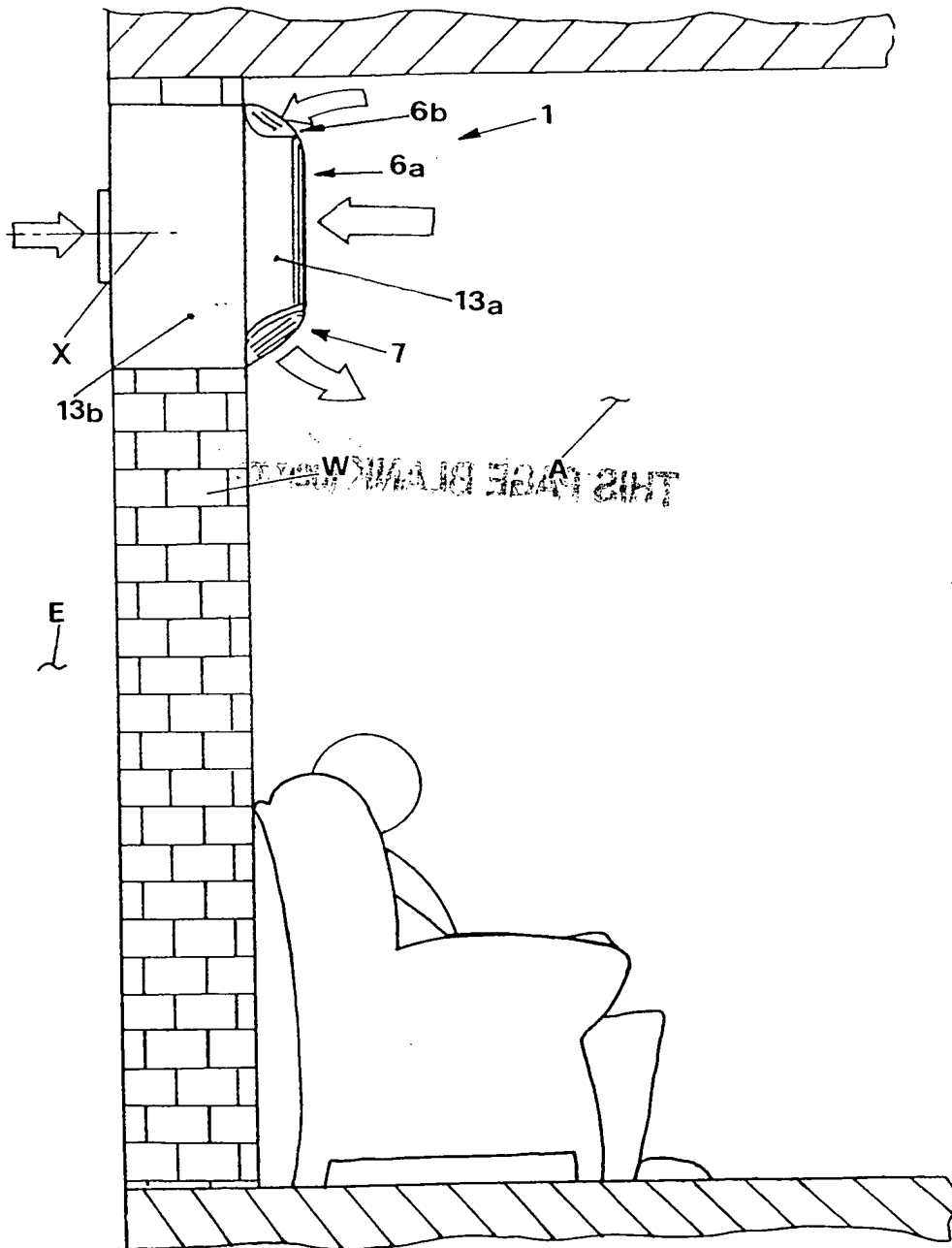


FIG.6

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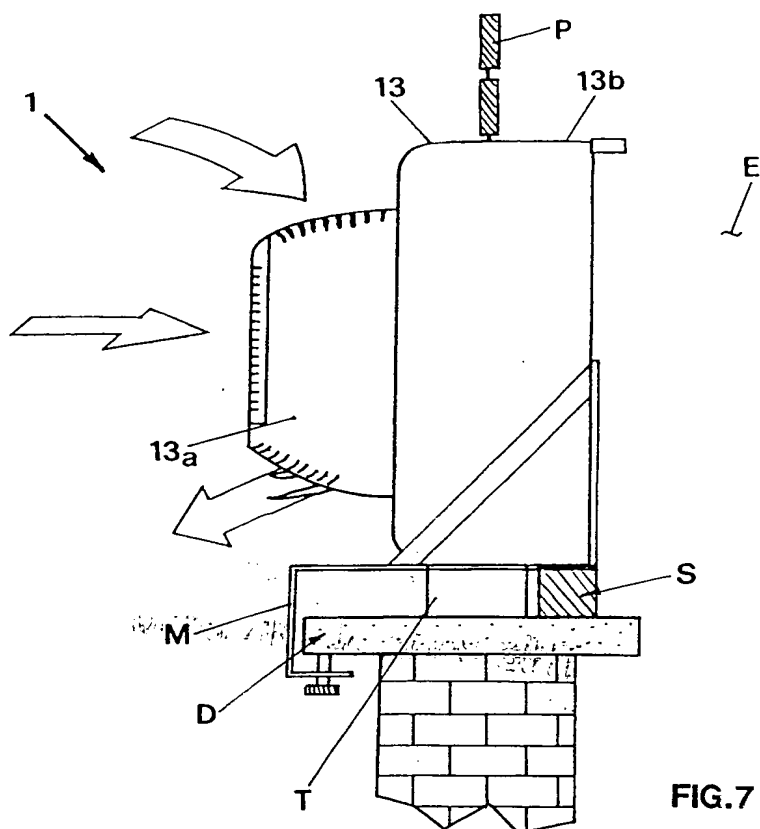


FIG. 7

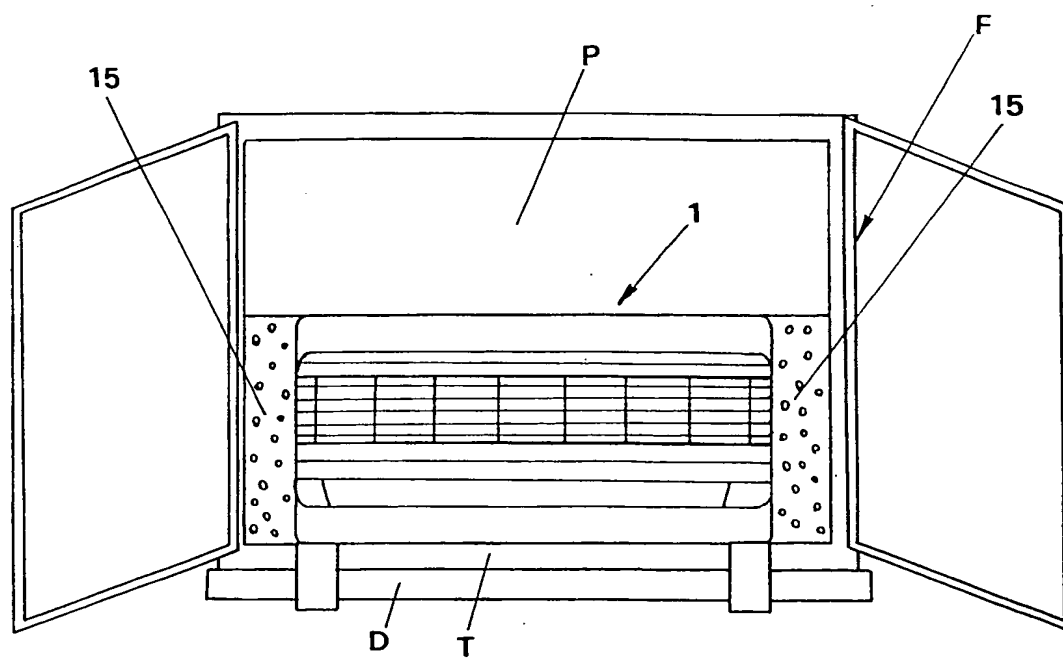


FIG. 8

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## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/0394

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F24F1/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 011, no. 050 (M-562), 17 February 1987 (1987-02-17) -& JP 61 213529 A (MATSUSHITA SEIKO CO LTD), 22 September 1986 (1986-09-22) abstract figure 3	1-3, 7, 8
A		4-6
X	FR 2 349 105 A (RIELLO CONDIZIONATORI GIORDANO) 18 November 1977 (1977-11-18) page 5, line 25 -page 9, line 24 claims 1-4, 6-8 figures 1-5	1, 2, 4, 7, 8
A		3, 5, 6
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

25 November 2003

Date of mailing of the international search report

02/12/2003

Name and mailing address of the ISA

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# INTERNATIONAL SEARCH REPORT

International Application No

T/EP 03/07394

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 637 223 A (SHIRAISHI AKIRA ET AL) 20 January 1987 (1987-01-20) column 2, line 53 -column 3, line 2 claim 1 figure 3	1
A	---	2,3,5-8
X	PATENT ABSTRACTS OF JAPAN vol. 014, no. 545 (M-1054), 4 December 1990 (1990-12-04) -& JP 02 230032 A (SANYO ELECTRIC CO LTD), 12 September 1990 (1990-09-12) abstract figure 1	1
A	---	2-4
A	US 3 279 209 A (NIKOLAUS LAING) 18 October 1966 (1966-10-18) figures 1,14,15	1-3,5-8
A	---	
A	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 22, 9 March 2001 (2001-03-09) -& JP 2001 141298 A (MITSUBISHI HEAVY IND LTD), 25 May 2001 (2001-05-25) abstract figure 2C	1-3,5,6
A	---	
A	FR 1 303 675 A (LAING M NIKOLAUS) 21 January 1963 (1963-01-21) the whole document	1-3
A	---	
A	US 5 551 508 A (DEVOS RICHARD ET AL) 3 September 1996 (1996-09-03) figures 1,2,5,7	1,5,6
A	---	
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 12, 26 December 1996 (1996-12-26) -& JP 08 219541 A (MATSUSHITA ELECTRIC IND CO LTD), 30 August 1996 (1996-08-30) abstract figures 1-7	
A	---	
A	US 2 917 905 A (MCGRATH WILLIAM L ET AL) 22 December 1959 (1959-12-22) figures 1-4	
A	---	
A	WO 01 07837 A (BOTTARO ORESTE ;OLIMPIA SPLENDID S P A (IT)) 1 February 2001 (2001-02-01) figures 2,3	
	-----	

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 0 7394

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 61213529	A	22-09-1986	NONE	
FR 2349105	A	18-11-1977	IT 1059231 B BR 7702452 A DE 2635136 A1 ES 457701 A1 FR 2349105 A1 NL 7703497 A US 4067204 A ZA 7702356 A	31-05-1982 17-01-1978 19-01-1978 01-05-1978 18-11-1977 25-10-1977 10-01-1978 29-03-1978
US 4637223	A	20-01-1987	JP 61027432 A KR 9002184 B1	06-02-1986 02-04-1990
JP 02230032	A	12-09-1990	JP 2594148 B2	26-03-1997
US 3279209	A	18-10-1966	US 3200609 A	17-08-1965
JP 2001141298	A	25-05-2001	NONE	
FR 1303675	A	21-01-1963	NONE	
US 5551508	A	03-09-1996	US 5404939 A CA 2103053 A1 JP 6511076 T WO 9222781 A1	11-04-1995 11-12-1992 08-12-1994 23-12-1992
JP 08219541 8	A		NONE	
US 2917905	A	22-12-1959	NONE	
WO 0107837	A	01-02-2001	IT RE990076 A1 AU 5847000 A EP 1116001 A1 WO 0107837 A1	29-01-2001 13-02-2001 18-07-2001 01-02-2001

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